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(54) Calling party identification authentication and routing in response thereto

(57) A method and system for indicating authentication of the identity of a calling party based on an intrinsic property of the calling party is disclosed. Representations of intrinsic properties of potential calling parties are gathered and stored as reference representations for use in comparisons with later acquired representations. When a later acquired representation matches an earlier acquired representation, authentication of the calling party is deemed to have occurred. Speedier authentication may be provided by using calling line identification information in conjunction with representation matches. When authentication occurs, a signal is produced to indicate same and such signal may be used in uniquely identifying the calling party or in routing the call, for example.

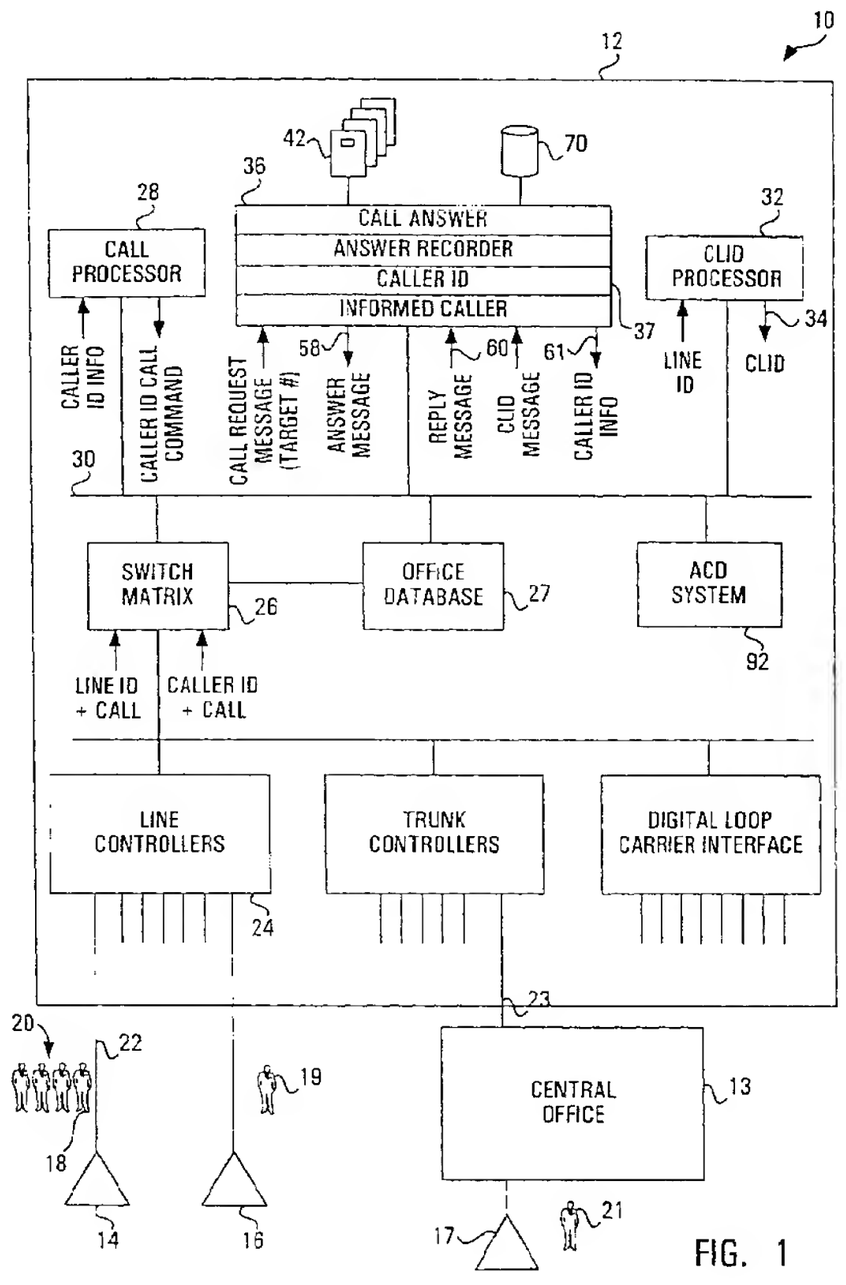

FIG. 1

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Description

BACKGROUND OF THE INVENTION

1. Field of the Invention

[0001] This invention relates to a method and system for indicating authentication of the identity of a calling party based on an intrinsic property of the calling party. More particularly, it relates to providing calling party identification in addition to, or instead of, calling line identification, and routing calls based on such information and/or accessing caller information for display or other purposes.

2. Description of Related Art

[0002] The use of calling line identification information to identify a calling party has found wide use in public switched telephony. However, calling line identification only provides a called party with the identity of the telephone line on which the call is initiated and the name of the registered subscriber of such line. As a household or business will often have only a single telephone line, or fewer telephone lines than people, multiple users of the same telephone line are not uniquely identified to the parties they call. Hence, calling line identification information is incomplete and unreliable with respect to identification of a specific calling party.

[0003] Identifying a specific calling party is commonly done after a telephone call is established. The called party or automated equipment on the called party's line, as in the case of a bank, may request the calling party to identify himself through the use of a personal identification number or functionally equivalent construct. The called party may then respond appropriately based on the identity indicated by the calling party. This however, requires that the calling party remember a unique identification number. Experience has shown that such numbers are easily forgotten or may be shared with other parties, such as spouses, for example. Consequently, the use of passwords to uniquely identify a calling party is not completely reliable and is vulnerable to misuse.

[0004] What would be desirable therefore is an efficient, conclusive and economical way of providing a called party with calling party information, such as calling party identity, unique to the person actually making the call and based upon nontransferable characteristics of the calling party.

SUMMARY OF THE INVENTION

[0005] The present invention addresses the above need by providing a method and system for indicating authentication of the identity of a calling party based on an intrinsic property of the calling party. Representations of intrinsic properties of potential calling parties are gathered and stored as reference representations for use in comparisons with later acquired representations. When a later acquired representation matches an earlier acquired representation, authentication of the calling party is deemed to have occurred. Speedier authentication may be provided by using calling line identification information in conjunction with representation matches. When authentication occurs, a signal is produced to indicate same and such signal may be used in uniquely identifying the calling party or in routing the call, for example.

[0006] In accordance with one aspect of the invention, there is provided a method of indicating authentication of the identity of a calling party. The method involves detecting an intrinsic property of the calling party, authenticating the identity of the calling party based on the intrinsic property and providing a signal to the called party in response to authentication of the calling party's identity. Such intrinsic properties may include but are not limited to voice profile, image, fingerprints, and DNA.

[0007] The system and method of calling party authentication can be performed at a central location such as a telephone company central office. In this way, a telephone service provider can maintain one large database of intrinsic properties to which service subscribers have access. Such a database is more comprehensive and therefore more effective than a database any single subscriber could practically create by itself. Furthermore, by providing a common speaker recognition service, common to a plurality of subscribers, the high cost of providing such services can be distributed among a plurality of users. Effectively, the central office acts as an intermediary placed between the calling party and the called party. In this way, the intermediary performs the authentication and sends an authentication signal to the called party before a communication link between the calling party and the called party is established.

[0008] Preferably, the authentication signal includes calling party information. This information may be used by the called party to automatically route the call within the called party's system or to provide improved customer service. Such improved customer service may include automatically generating and filling in a customer database record.

[0009] The authentication signal may also be used to implement a password-free security system. In the absence of an authenticated identity, the intermediary may refuse to complete the call or the called party could refuse to accept

the call. Additionally, in the event of a valid authentication signal and unique calling party identity, the called party's equipment might permit access but only to the extent permitted for that particular person.

[0010] The apparatus may include an automatic call direction system located inside a central office or in a PBX system, for example, for directing a call in response to authentication of the calling party or in response to the authentication signal.

[0011] The apparatus may also include an automatic system for retrieving a customer database file and for displaying the contents of such file for the called party to view.

[0012] Other aspects and features of the present invention will become apparent to those ordinarily skilled in the art upon review of the following description of specific embodiments of the invention in conjunction with the accompanying figures.

BRIEF DESCRIPTION OF THE DRAWINGS

[0013] In drawings which illustrate embodiments of the invention,

Figure **1** is a block diagram of a system for providing calling party identification according to a first embodiment of the invention;

Figures **2**A and **2**B are first and second parts respectively, of a flowchart of a calling party identification routine run on an authenticating processor of the system shown in Figure **1**;

Figure **3** is a representative subscriber database record accessible by the authenticating processor; and

Figure **4** is a representative calling party database record accessible by the authenticating processor.

DETAILED DESCRIPTION

[0014] Referring to Figure **1**, a system for indicating authentication of the identity of a calling party based on an intrinsic property of the calling party is shown generally at **10**.

[0015] In this embodiment the system includes a central office **12**, calling party customer premises equipment **14** and called party customer premises equipment **16**. The calling party customer premises equipment **14** is operated by a first calling party **18.** It will be appreciated however that a plurality of calling parties shown generally at **20**, including the first calling party **18**, may use the same customer premises equipment **14**. Effectively, the invention provides a way of identifying to the called party customer premises equipment **16**, which of the calling parties from the plurality of calling parties **20** is making a call to the called party customer premises equipment **16**, using the calling party equipment **14**. In other words, authentication of the calling party is provided.

[0016] To this end, the first calling party **18**, for example, dials on the calling party customer premises equipment **14**, the telephone number of the called party customer premises equipment **16**.

[0017] The calling party customer premises equipment **14** is connected to the central office **12** through a telephone line **22** which is terminated at a line controller **24**. The line controller **24** detects the calling party customer premises equipment **14** going off hook and stores an equipment number of the telephone line **22** of the calling party customer premises equipment in a service request buffer (not shown). The contents of this service request buffer are passed through a switch matrix **26** in the central office **12** to a call processor **28** which uses the contents of the service request buffer to search an office database **27** to identify the characteristics of the calling party customer premises equipment including directory number, dial pulse or touch tone signalling, etc. The call processor **28** then creates a call record in temporary storage (not shown), locates an idle digit receiver (not shown) that matches the signalling characteristics of the calling party customer premises equipment **14** and finds a path through the switch matrix **26** between the telephone line **22** of the calling party and the digit receiver and connects them. This sequence is followed by return of dial tone to the calling party customer premises equipment **14** and initiation of a digit scan program that scans the digit receiver for dialled digits and collects them in a digit buffer (not shown). A digit analysis program is then run on the contents of the digit buffer to identify and validate the called numbers. When satisfied that the number has been received correctly and that it is a valid directory number, a caller ID command message is sent from the call processor **28**, on a common messaging bus **30** to a calling line identification processor **32**. The calling line identification processor **32** returns a calling line identification information message **34** on the common messaging bus **30** which is received at an authenticating processor **36**. This calling line identification information is held in a caller ID buffer **37**. Thus the calling line identification processor acts as a calling line information detector for detecting calling line identification information of the calling party.

[0018] At the same time, the valid directory number dialled at the calling party customer premises equipment **14** is

included in a message sent from the call processor **28** to the authenticating processor **36** as a call request message including a target directory number. The authenticating processor **36** receives the call request message and runs a caller identification (ID) routine shown generally at **38** in Figure **2**A.

[0019] Referring to Figures **1** and **2**A, the caller ID routine **38** begins with a first block **40** which directs the authenticating processor **36** to locate a subscriber record in a subscriber database shown generally at **42**. The subscriber database holds subscriber records corresponding to called parties who subscribe to the calling party identification service. Referring to Figure **3**, a representative subscriber database record is shown generally at **44** and includes a called number field **46**, a subscriber message field **48** including a pre-recorded message associated with the subscriber, and an index field 50 for storing an index to a calling party database. The subscriber database **42** could be organized and searched using the called number field **46** as an index, for example.

[0020] Referring back to Figures **1** and **2**A, if no corresponding subscriber database record **44** is found, the called party is not a calling party identification service subscriber and the caller ID routine is terminated. The authenticating processor **36** is directed, at block **52** in Figures **1** and **2**B, to send a message to the call processor **28** indicating that it may complete the call with no authentication signal being provided although calling line identification information may be provided.

[0021] Referring back to Figures **2**A and **3**, if a subscriber database record **44** is found in the subscriber database **42**, the authenticating processor **36** functions as an interceptor to intercept the establishment of a communications link between the calling party and the called party and instead establishes communications between the calling party and itself. Thus, communications are established between the first calling party **18** and an intermediary between the first calling party **18** and the called party, the intermediary being the authenticating processor **36**. At this point, block **54** directs the authenticating processor **36** to function as a prompter by retrieving the contents of the subscriber message field **48** and sending a subscriber message **58** on the common messaging bus **30**, through the switch matrix **26** and to a line controller **24** such that the message is annunciated at the calling party customer premises equipment **14**. The subscriber message **58** prompts the first calling party **18** to provide an intrinsic property of itself. The subscriber message **58** may be audible or visual or any other form which elicits a response from the first calling party **18**. In this embodiment for example, the subscriber message **58** is audible and thus the subscriber message **58** is converted into an audible signal audible to the first calling party **18**.

[0022] In response to hearing the subscriber message **58**, the first calling party **18**, responds with a submission of something containing an intrinsic property of the calling party, in this embodiment an audible utterance which may be the first calling party's name or other word or phrase for example. Such response is preferably audible but could alternatively be a fingerprint imprint, facial image, or any other submission which includes an intrinsic property of the first calling party **18**. In this embodiment, where an audible response is obtained from the first calling party **18**, the intrinsic feature of the audible response is a voice profile of the utterance, more particularly the frequency spectrum and smoothness characteristics of the calling party's voice utterance.

[0023] The calling party's utterance is received by the line controller **24** which provides a reply message **60**, representing the calling party's utterance, to the authenticating processor **36**. In this embodiment therefore, the line controller acts as a receiver for detecting a voice utterance of the calling party. Referring back to Figure **2**A, the authenticating processor functions as a recorder by recording the calling party's reply message **60** into temporary storage under the direction of block **66**.

[0024] Referring back to Figures **1** and **2**A, during the period between the time the subscriber message **58** is transmitted to the first calling party **18** and the calling party's reply message **60** is received, block **62** directs the authenticating processor **36** to wait for the calling party's reply and block **64** directs the authenticating processor **36** to wait no longer than a predetermined period. Such period may be ten seconds, for example. If the first calling party **18** does not reply within ten seconds, the authenticating processor **36** is directed to issue a complete call message by block **52** and the call processor **28** completes the call. In this circumstance, no authentication signal will be transmitted, only calling line identification information.

[0025] Block **68** then directs the authenticating processor **36** to locate a calling party database record by searching in a second, calling party information database **70** of calling party information. Referring to Figure **4**, a representative calling party database record is shown generally at **72** and includes index fields **74** associated with respective subscribers of the service, a calling line identification field **76**, a voice print field **78**, a customer public information field **80** and a plurality of subscriber-specific customer information fields **81** related to corresponding index fields **74**. The voice print field **78** holds a representative previously acquired voice print of the calling party and thus, the information database includes a database of intrinsic property profiles, including voice profiles, associated with respective calling party information.

[0026] Generally, the search of the calling party database could be performed by using any of the search algorithms known in the art. without limiting the generality of the search, the database could be searched linearly i.e. comparing each record consecutively or searched by using the calling line identification number as an index, or by having the calling party enter a unique code number as an index before making the identifying utterance, or by speech recognition,

for example. Or any combination of these search methods or others could be employed.

[0027] Preferably, however, as in this embodiment the authenticating processor **36** is programmed to act as a speech recognizer for recognizing speech provided by the calling party to attempt to locate possible records. In addition, calling line identification information is used on a pass through the information database to narrow the search to the most likely records. As a result of these searches, a few possible records may be located, or more generally, information relating to the calling party is located in response to speech recognized by the speech recognizer and calling line identification information. If further narrowing is desired, the authenticating processor may search the records for a match with a password provided by the calling party.

[0028] Referring back to Figure **2**A, if no calling party record is located in the search, block **82** directs the authenticating processor **36** to create a new calling party record wherein the index field is copied from the index field **50** of the subscriber database record **44** shown in Figure **3**, the calling line identification field **76** is copied from the caller ID buffer **37** and the voice print field **78** is copied from the reply message **60**. The office database **27** provides the contents of the customer public information field **80** and the subscriber-specific customer information field **81** associated with the subscriber indicated by the index field **50** is filled at a later time by the called party/subscriber.

[0029] Referring to Figures **1** and **2**B, after generating a new calling party record, the authenticating processor **36** is directed to block **52** which issues a message to the call processor **28** to complete the call without providing an authentication signal, instead, only calling line identification information is provided in the usual manner by transmitting FSK encoded signals to the called party. Thus, at least some identifying information about the calling party is provided to the called party.

[0030] Referring back to Figures **1**, **2**A and **2**B, if at block **68**, a calling party database record **72** is located, block **86** directs the authenticating processor **36** to function as a voice recognizer, or more specifically as a speaker recognizer, and to perform speaker recognition analysis by producing a voice profile for the utterance made by the calling party and comparing the voice profile of such utterance with the voice profile of the contents of the voice print field **78** of the calling party database record **72**. The authenticating processor thus acts as a detector for detecting an intrinsic property, in this embodiment a voice profile, of the calling party.

[0031] The authenticating processor acts as a speaker recognizer for recognizing the calling party as a particular speaker by comparing the voice utterance to the voice profiles and the authenticating processor is programmed to provide authentication of the calling party in response to recognizing the calling party. If the voice profile of the utterance matches the voice profile of a calling party database record, in other words, if the spectral content and smoothness characteristics are a sufficiently close match, the speaker is recognized and authentication is deemed to have occurred. The authenticating processor thus acts to authenticate the identity of the calling party, based on the intrinsic property detected in the calling party's utterance.

[0032] Alternatively, the authenticating processor may require a confirmed match of both the intrinsic property and the calling line identification information to authenticate the identity of the calling party.

[0033] Block **88** then directs the authenticating processor 36 to produce a caller ID information message **61**. The caller ID information message includes the contents of the calling line identification field **76**, the contents of the customer public information field **80** and the contents of the subscriber-specific customer information field **81**. The contents of the subscriber specific customer information field may be rather large, including for example customer information specifically of interest to the subscriber such as social insurance number, make of car, etc., for example. The caller ID information message **61** so produced is sent to the call processor **28** on the common messaging bus **30**. The authenticating processor **36** is then directed to block **52**, which directs the call processor **28** to complete the call.

[0034] The call processor **28** completes the call in the normal manner by activating the appropriate line controller to establish a connection to a called party customer premises equipment **16** to establish communications between the called party and the calling party. Before, during or after the ringing phase of the call, the call processor **28** transmits codes to the line controller associated with the called party customer premises equipment **16** to produce a frequency shift keyed (FSK) modulated signal which is receivable by the called party customer premises equipment **16**. Thus, the line controller acts as a transmitter for transmitting the authentication signal to the called party as an encoded signal representing information associated with the calling party. The FSK signal acts as an authentication signal indicating authentication of the calling party and may be formatted in the multi-data messaging format (MDMF) or the ADSI data messaging format, for example, for transmission to the called party customer premises equipment **16**. This authentication signal is only produced in response to the authentication of the calling party identity. The authenticating signal may simply indicate authentication or not by simple transmission of a "YES" or "NO" indication, but preferably it includes at least some calling party information obtained from the located record in the information database. The information contained within the FSK signal may then be displayed on a display at the called party customer premises equipment **16** or may be transferred to a computer connected to the called party customer premises equipment **16** for display, for example.

[0035] Referring back to Figure **2**B, if at block **86**, the voice print of the caller reply message **60** and the contents of the voice print field **78** do not match, block **90** directs the authenticating processor **36** to produce a partial caller ID

information message indicating that there was no voice profile match and that the calling party's identity could not be authenticated. The authenticating processor **36** then sends this message to the call processor **28** on the common messaging bus **30**.

[0036] Block **52** then directs the authenticating processor **36** to send a complete call message to the call processor **28** which sends an FSK message to the called party as described above, with calling line identification information but no authentication signal, as no voice profile match was obtained.

[0037] If an FSK message including calling party identification information, such as calling party identity, is received at the called party customer premises equipment **16**, such information may be used for display on a computer or may be used to route a call by a private branch exchange (PBX) of the called party or by a central office to which the called party is connected, for example.

[0038] To achieve call routing at a central office, the central office is provided with an Automatic Call Direction (ACD) system **92**. Such systems conventionally respond to caller-supplied DTMF signals however, in this embodiment, the ACD system is reconfigured to respond to the contents of the caller id message **61** in place of or in addition to user-supplied DTMF signals to route calls. Consequently, calls are routed in response to the customer information obtained in response to authentication.

[0039] Alternatively, the ACD system **92** may be external to the central office, located at a customer PBX, for example. In this case, the ACD system is reconfigured to receive the authentication signal sent by the central office, to extract the customer information therefrom and to respond to the contents of the caller id message **61** in place of or in addition to user-supplied DTMF signals to route calls. Consequently, calls are routed in response to the authentication signal.

[0040] The foregoing description has assumed that the calling party customer premises equipment **14** and called party customer premises equipment **16** are connected to a common central office **12**. The system and method herein will also work where the calling party customer premises equipment **17** and the called party customer premises equipment 16 do not share a central office.

[0041] Referring to Figure **1**, where a second calling party **21** and the called party **19** are served by different central offices, the subscriber database **42** and the calling party information database **70** are located at the central office **12** which serves the called party. In operation, the called party's central office **12** may receive the calling party's calling line identification information and the dialled telephone number from the calling party's central office **13** via an SS**7** data-link (not shown) and the calling party's utterance along the trunk line **23**. The called party's central office **12** uses this information to perform the calling party identification method described above.

[0042] While specific embodiments of the invention have been described and illustrated, such embodiments should be considered illustrative of the invention only and not as limiting the invention as construed in accordance with the accompanying claims.

Claims

1. A method of providing a called party with calling party authentication, comprising:

a) detecting an intrinsic property of said calling party;

b) authenticating the identity of said calling party, based on said intrinsic property; and

c) providing an authentication signal to said called party in response to authentication of said calling party.

2. A method as claimed in claim **1** further including accessing an information database of calling party information in response to authentication of the identity of said calling party.

3. A method as claimed in claim **2** further including representing at least some of said calling party information in said authentication signal.

4. A method as claimed in claim **3** wherein providing said authentication signal includes transmitting to said called party, encoded signals representing information associated with said calling party.

5. A method as claimed in claim **2** further including searching a database of intrinsic property profiles associated with respective said calling party information to locate an intrinsic property profile matching said intrinsic property of said caller.

6. A method as claimed in claim **5** further including searching voice profiles in said database of intrinsic property

profiles.

7. A method as claimed in claim **6** further including receiving a voice utterance from said calling party.

8. A method as claimed in claim **7** further including employing a speaker recognizer for comparing said voice utterance to said voice profiles to recognize said calling party as a particular speaker.

9. A method as claimed in claim **8** wherein authentication of said calling party is provided in response to recognizing said calling party.

10. A method as claimed in claim **9** further including recognizing speech provided by said calling party prior to authenticating the identity of said calling party.

11. A method as claimed in claim **10** further including locating information relating to said calling party in response to speech recognized by said speech recognizer.

12. A method as claimed in claim **1** further including receiving a password from said calling party and searching said information database for said password.

13. A method as claimed in claim **1** further including detecting calling line identification of said calling party.

14. A method as claimed in claim **13** wherein authenticating includes authenticating the identity of said calling party on the basis of said intrinsic property and said calling line identification information.

15. A method as claimed in claim **1** further including establishing communications between said called party and said calling party.

16. A method as claimed in claim **15** further including establishing communications between said calling party and an intermediary between said calling party and said called party.

17. A method as claimed in claim **16** further including intercepting the establishment of a communications link between said calling party and said called party.

18. A method as claimed in claim **1** further including routing a call made by said calling party in response to authentication of the identity of said party.

19. A method as claimed in claim **2** further including routing a call made by said calling party in response to said calling party information.

20. A method as claimed in claim **1** further including routing a call made by said calling party in response to said authentication signal.

21. A system for providing a called party with calling party authentication, comprising:

a) a detector for detecting an intrinsic property of said calling party;

b) an authenticating processor for authenticating the identity of said calling party, based on said intrinsic property; and

c) a signal generator for generating an authentication signal for said called party in response to authentication of said calling party.

22. A system as claimed in claim **21** further including an information database of calling party information accessible by said authenticating processor.

23. A system as claimed in claim **22** wherein said signal generator is operable to represent at least some of said calling party information in said authentication signal.

24. A system as claimed in claim **23** further including a transmitter for transmitting said authentication signal to said called party as an encoded signal representing information associated with said calling party.

25. A system as claimed in claim **22** further including a database of intrinsic property profiles associated with respective said calling party information, said database of intrinsic property profiles being searchable by said authenticating processor.

26. A system as claimed in claim **25** wherein said intrinsic property profiles include voice profiles.

27. A system as claimed in claim **26** wherein said detector is operable to receive a voice utterance from said calling party.

28. A system as claimed in claim **27** wherein said authenticating processor includes a speaker recognizer for recognizing said calling party as a particular speaker by comparing said voice utterance to said voice profiles.

29. A system as claimed in claim **28** wherein said authenticating processor is programmed to provide authentication of said calling party in response to recognizing said calling party.

30. A system as claimed in claim **29** wherein said authenticating processor includes a speech recognizer for recognizing speech provided by said calling party prior to authenticating the identity of said calling party.

31. A system as claimed in claim **30** wherein said authenticating processor is programmed to locate information relating to said calling party in response to speech recognized by said speech recognizer.

32. A system as claimed in claim **21** wherein said detector is operable to receive a password from said calling party and said authenticating processor is operable to search said information database for said password.

33. A system as claimed in claim **21** further including a calling line identification information detector for detecting calling line identification of said calling party.

34. A system as claimed in claim **33** wherein said authenticating processor is programmed to authenticate the identity of said calling party on the basis of said intrinsic property and said calling line identification information.

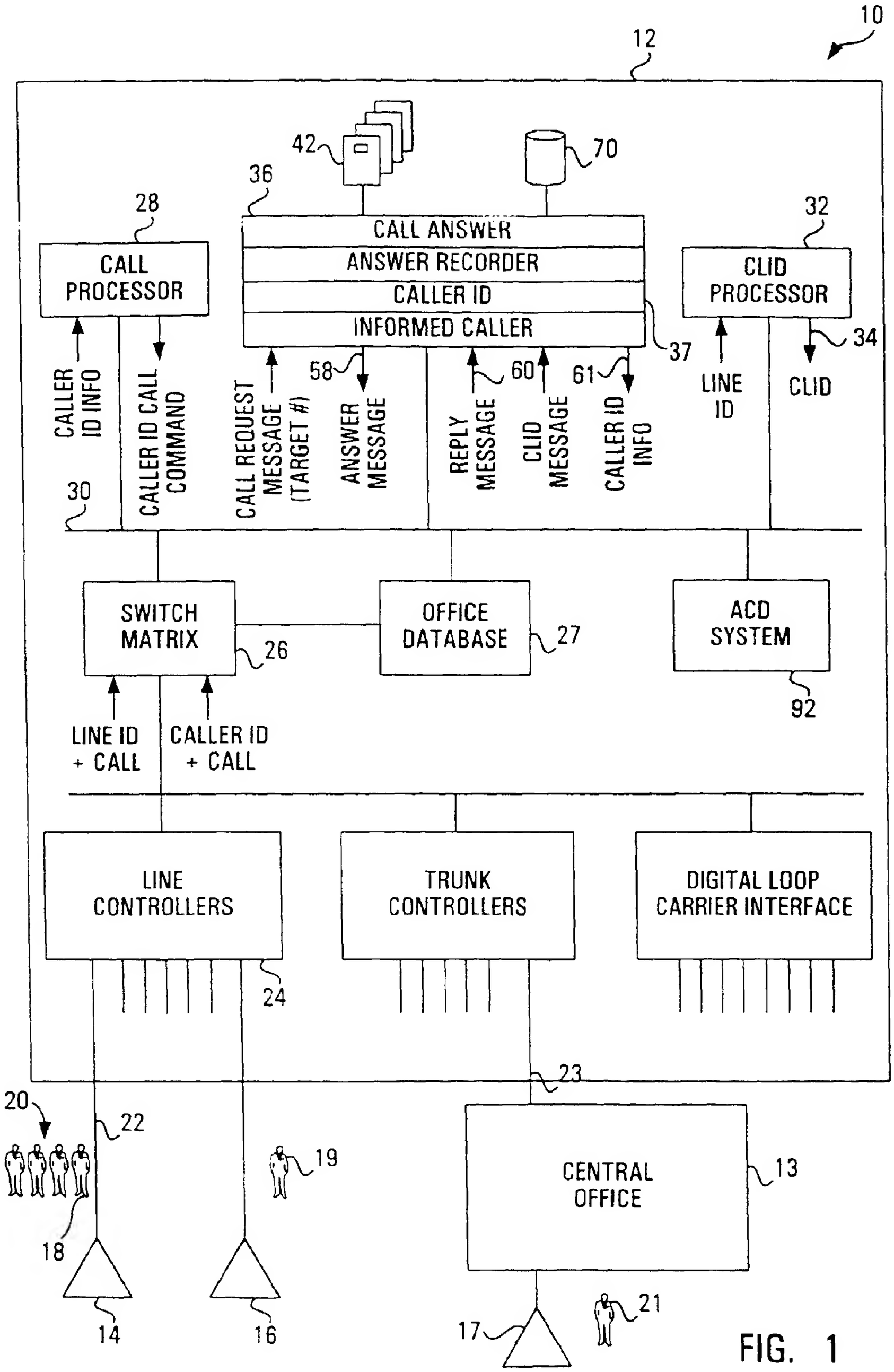
35. A system as claimed in claim **21** further including a call processor for establishing communications between said called party and said calling party.

36. A system as claimed in claim **35** wherein said call processor is operable to establish communications between said calling party and an intermediary between said calling party and said called party.

37. A system as claimed in claim **36** wherein said intermediary includes said authenticating processor.

38. A system as claimed in claim **36** wherein said authenticating processor is programmed to intercept the establishment of a communications link between said calling party and said called party.

39. A system as claimed in claim **18** further including an automatic call direction system responsive to said authentication signal for routing a call made by said calling party in response to said authentication signal.


10
12
42
70
36
28
32
CALL ANSWER
ANSWER RECORDER
CALLER ID
INFORMED CALLER
37
CALL PROCESSOR
CLID PROCESSOR
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58
60
61
LINE ID
CLID
CALLER ID + CALL INFO
CALLER ID CALL COMMAND
CALL REQUEST MESSAGE (TARGET #)
ANSWER MESSAGE
REPLY MESSAGE
CLID MESSAGE
CALLER ID INFO
30
SWITCH MATRIX
26
OFFICE DATABASE
27
ACD SYSTEM
92
LINE ID + CALL
CALLER ID + CALL
LINE CONTROLLERS
TRUNK CONTROLLERS
DIGITAL LOOP CARRIER INTERFACE
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23
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22
19
CENTRAL OFFICE
13
18
14
16
17
21

FIG. 1

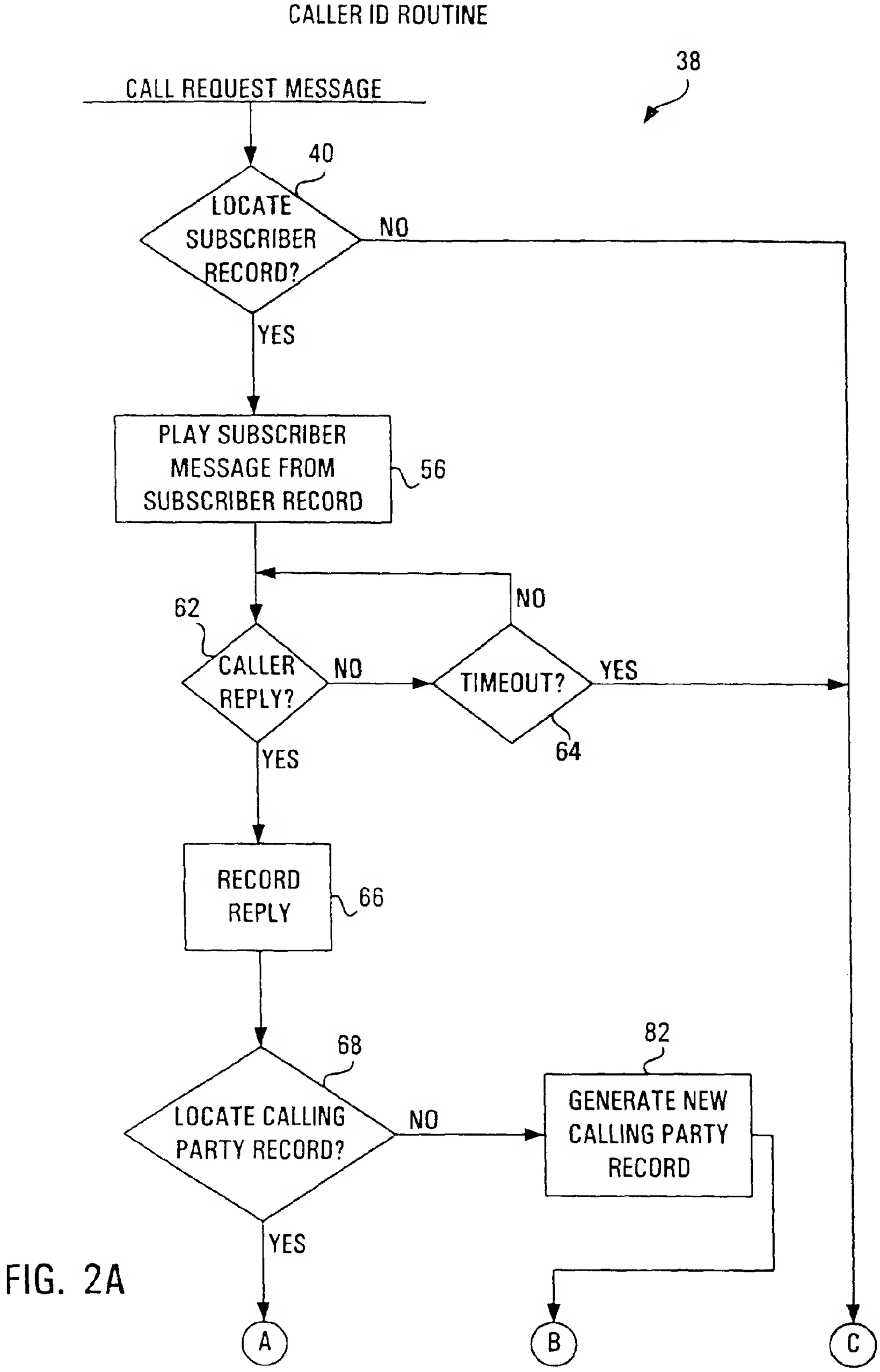
CALLER ID ROUTINE
38
CALL REQUEST MESSAGE
40
LOCATE SUBSCRIBER RECORD?
NO
YES
PLAY SUBSCRIBER MESSAGE FROM SUBSCRIBER RECORD
56
62
CALLER REPLY?
NO
TIMEOUT?
YES
64
NO
YES
RECORD REPLY
66
68
LOCATE CALLING PARTY RECORD?
NO
82
GENERATE NEW CALLING PARTY RECORD
YES
A
B
C

FIG. 2A

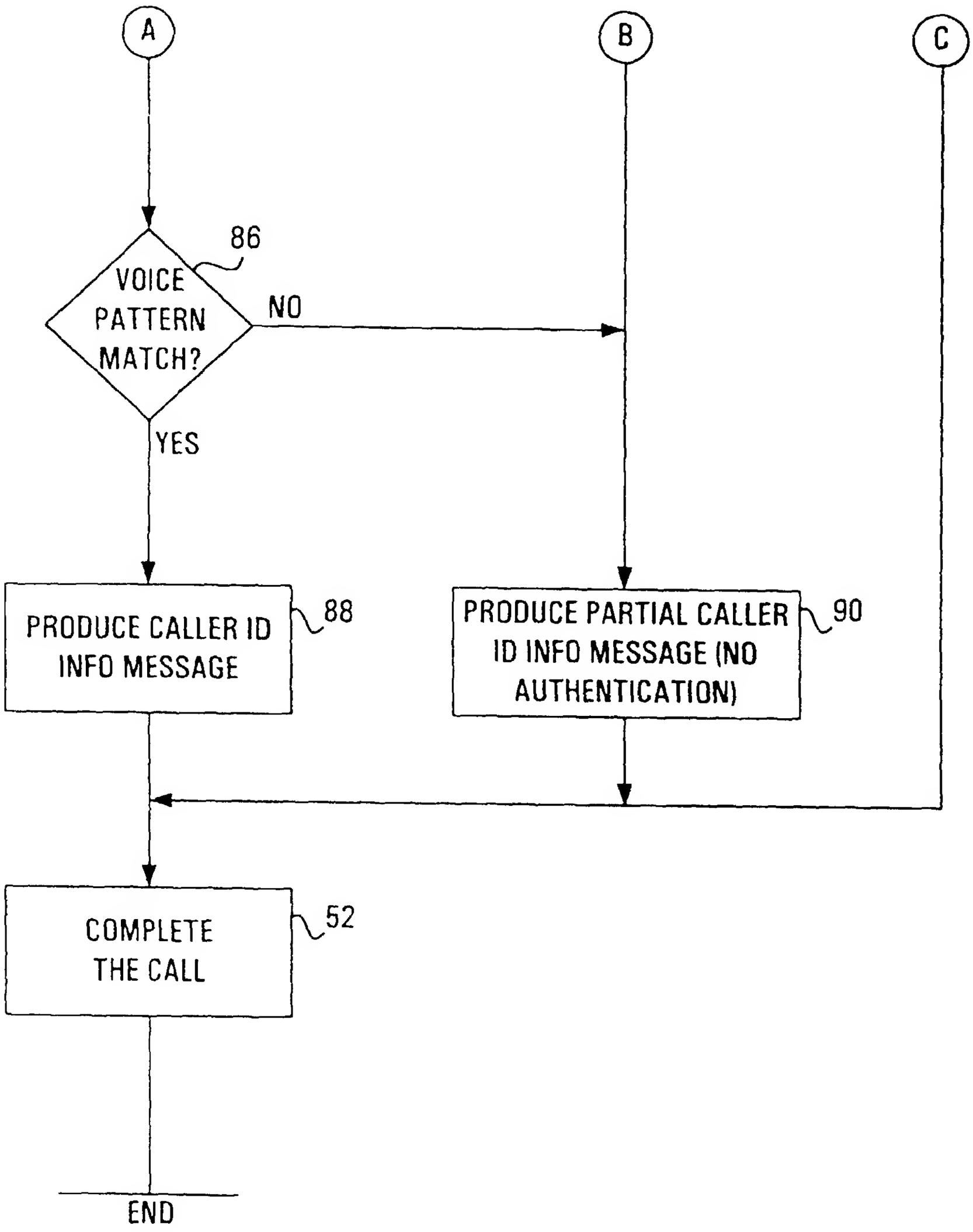
A
B
C
86
VOICE PATTERN MATCH?
NO
YES
PRODUCE CALLER ID INFO MESSAGE
88
PRODUCE PARTIAL CALLER ID INFO MESSAGE (NO AUTHENTICATION)
90
COMPLETE THE CALL
52
END

FIG. 2B

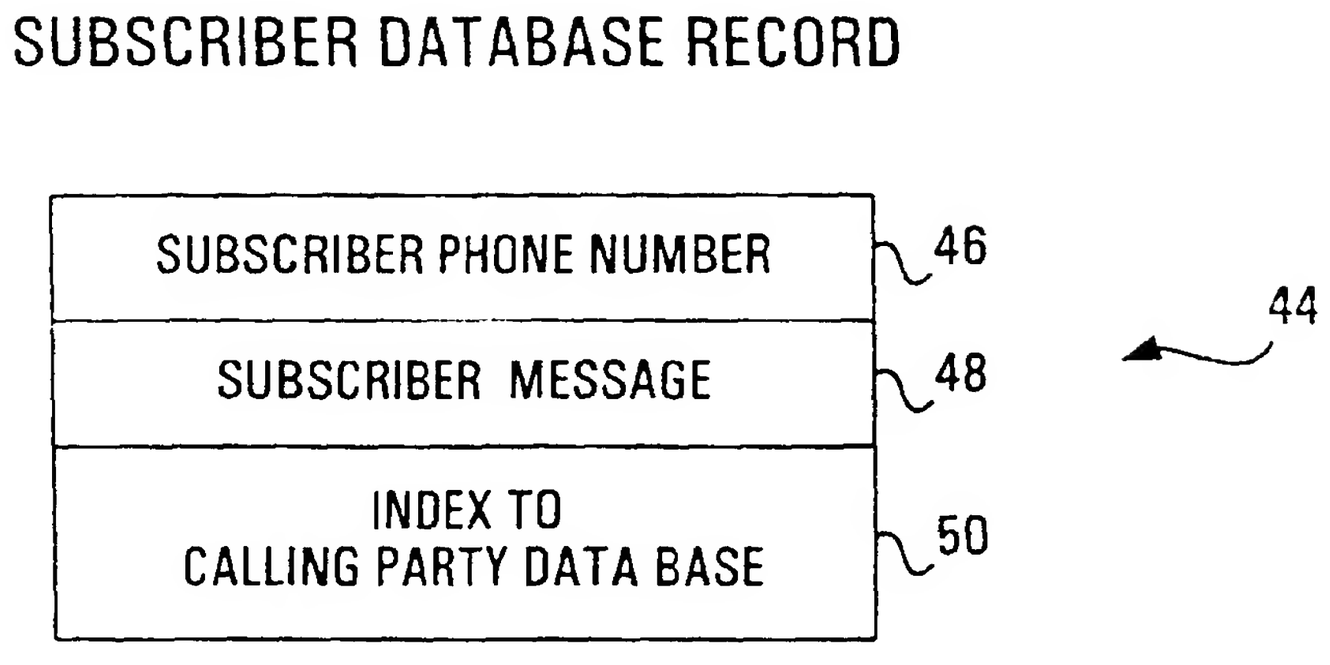
SUBSCRIBER DATABASE RECORD
SUBSCRIBER PHONE NUMBER
46
SUBSCRIBER MESSAGE
48
INDEX TO
CALLING PARTY DATA BASE
50
44

FIG. 3

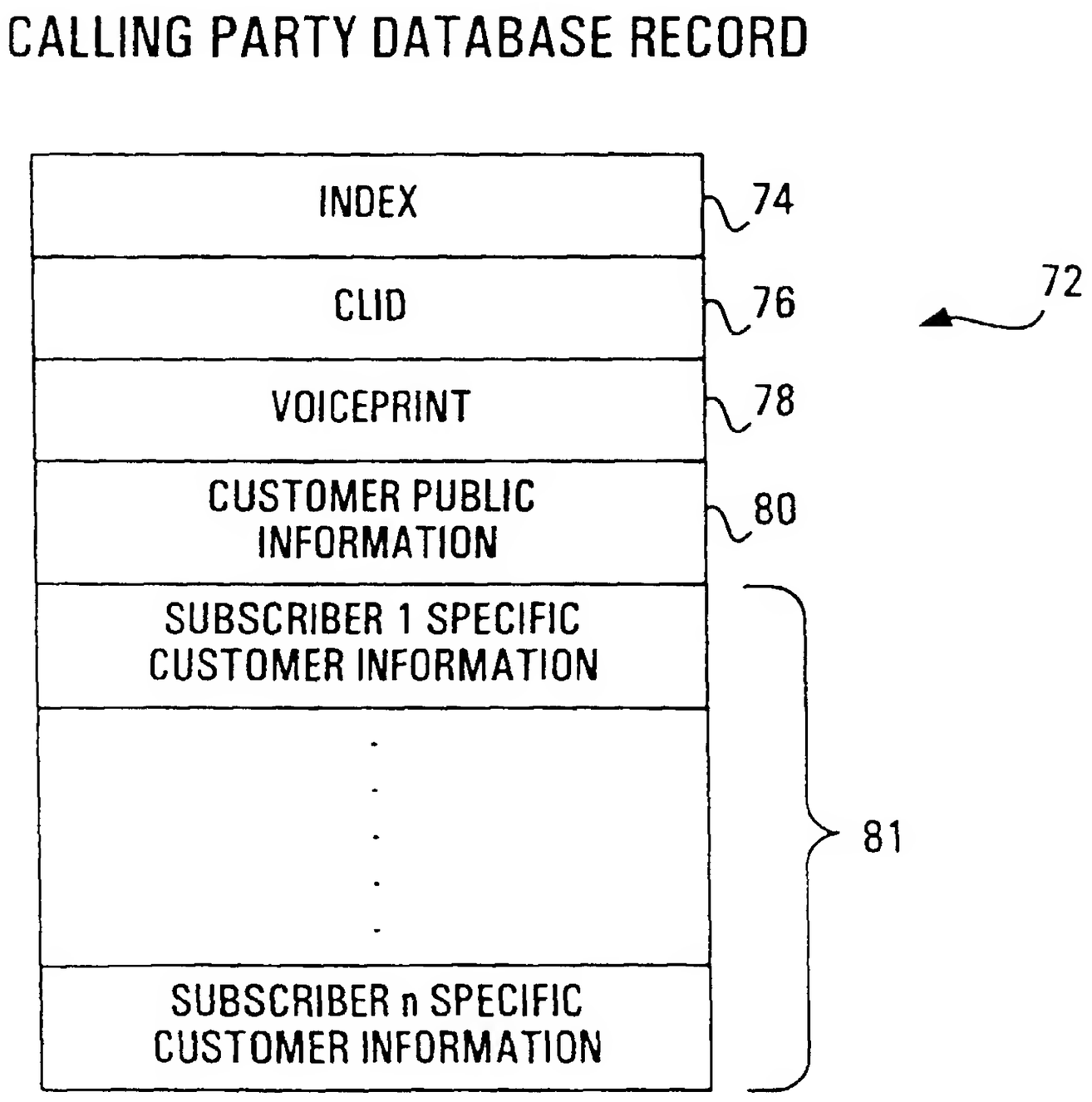
CALLING PARTY DATABASE RECORD
INDEX
74
CLID
76
VOICEPRINT
78
CUSTOMER PUBLIC
INFORMATION
80
SUBSCRIBER 1 SPECIFIC
CUSTOMER INFORMATION
SUBSCRIBER n SPECIFIC
CUSTOMER INFORMATION
81
72

FIG. 4